Computer Networks

Subject Code
CA 1114A
4th Semester

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SMIT

Chapter 1

Module

Introduction to Computer Networks and layered Architecture

Contents

- Introduction to Network
- Network Topology
    - Bus
    - Ring
    - Tree
    - Star
    - Mesh
    - Hybrid
- Layered Architecture
    - Open system Interconnection (OSI)
    - Transmission Control Protocol(TCP)/Internet Protocol (IP)

Introduction

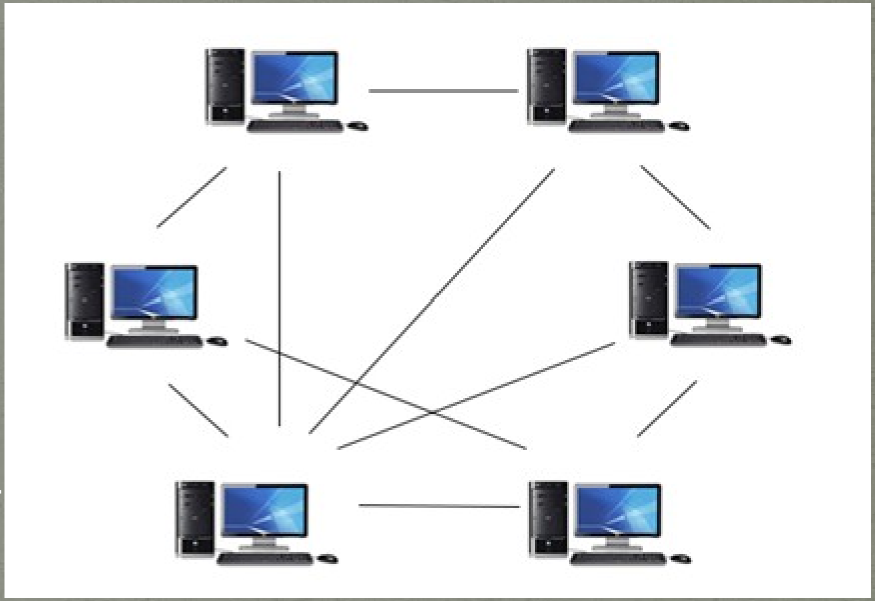
- Definition of Network

- Elementary Terminology

- Application and Uses of Network
  - Resource Sharing
  - Reliability
  - Cost factor
  - Communication medium

Network

- Definition
- Node
- Communication link



BASIC CHARACTERISTICS

- Fault Tolerance
  - Failures
  - Service
- Scalability
  - Growth
  - Good Performance
- Quality of Service
  - Set priorities
    Manage traffic delays
- Security
  - Ability to prevent Unauthorized access; Misuse: Forgery
  - Confidentiality: Integrity : Availability

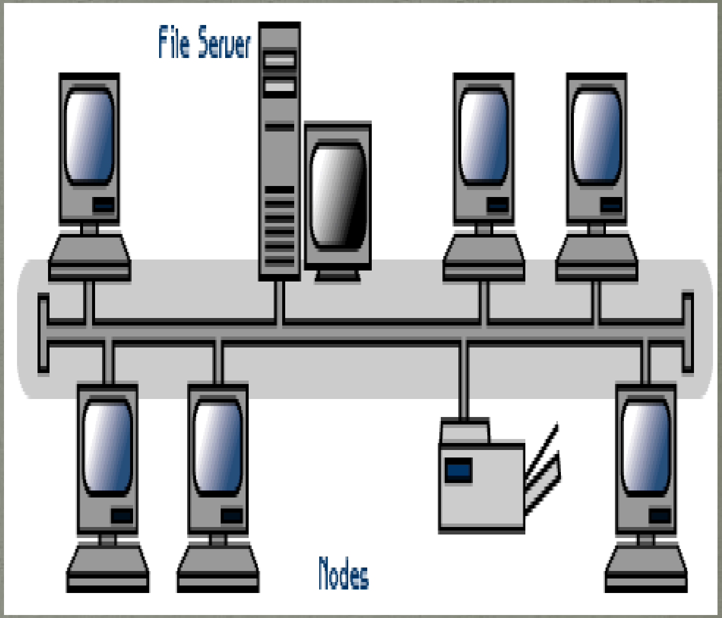
Network Topology

Arrangements of nodes of a computer network

- Bus
- Ring
- Tree
- Star
- Mesh
- Hybrid

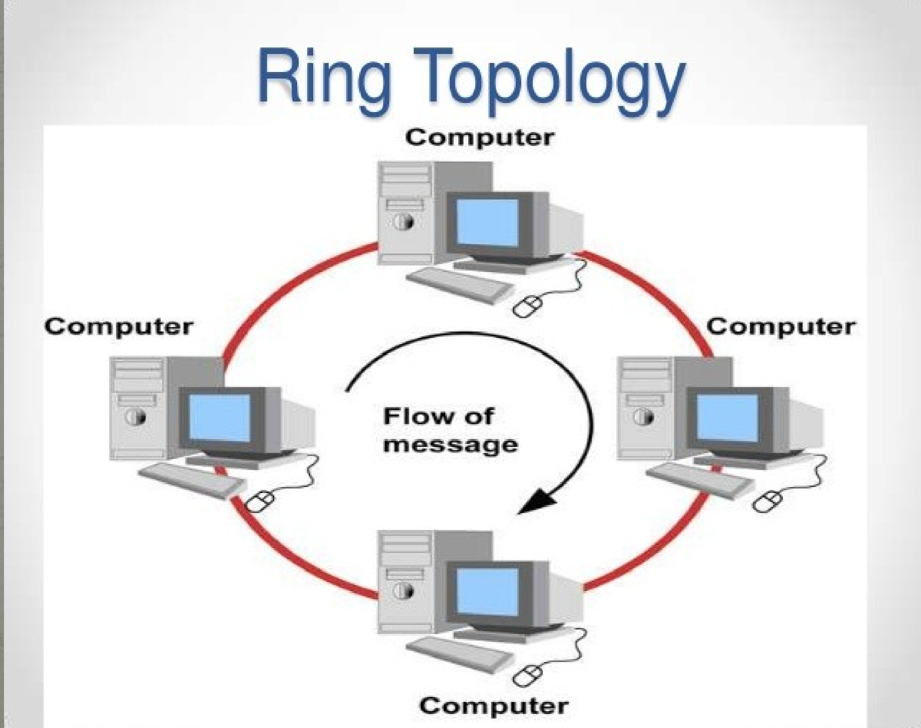
Bus or Linear Topology

- Features
  - Backbone
  - Tap
  - Drop line
- Advantage
  - Short Cable length (less cost)
  - Resilient Architecture(Node Failure)
  - Easy to extend
- Disadvantages
  - Fault diagnosis
  - Fault isolation
  - Not fault tolerant (no redundancy)
  - No Security
- Example
  - Ethernet



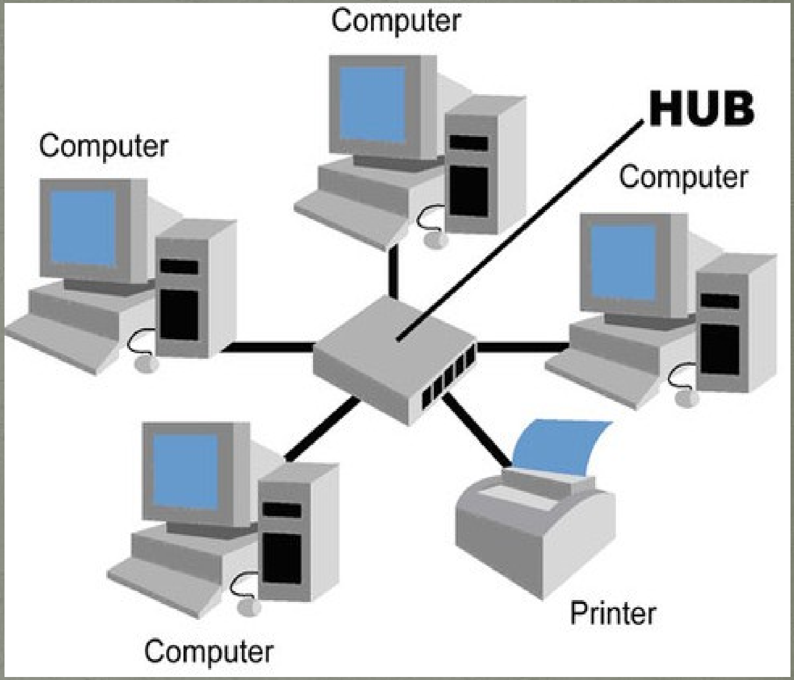
Ring or Circular Topology

- Features
  - Bus Topology in a closed loop
  - Peer to Peer (Every node is equal)
  - Clockwise or anti clockwise
  - Token Passing
- Advantage
  - Better performance than Bus
  - Short cable length
  - Optical fibres
- Disadvantage
  - Node failure (link) whole network
  - Diagnose faults
  - Network reconfiguration
  - Security
- Example
  - IBM Token Ring
  - IEEE802.5



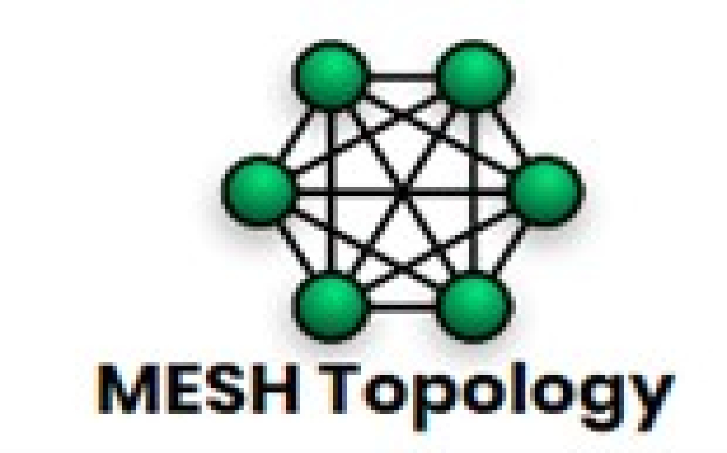
Star Topology

- Features
  - Central Node (Hub/ switch)
  - Single path
  - Centralized control
- Advantages
  - Ease of Service
  - Security is better
  - Centralized Administration
  - Scalable
- Disadvantages
  - Long cable length
  - Bottleneck due to overloaded hub
  - Central node dependency
- Example
  - Asynchronous Mode (ATM)



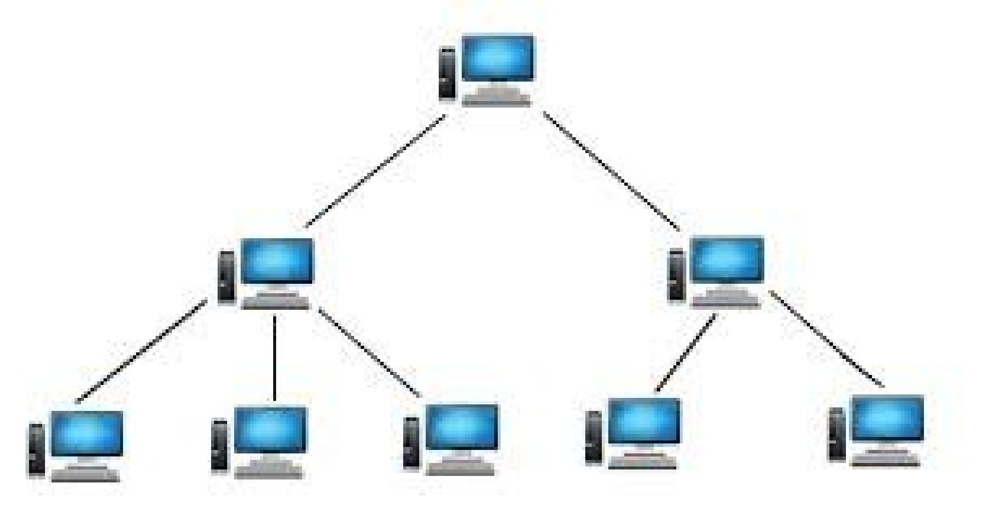
MESH TOPOLOGY

- Features
  - Each node is directly connected to all the node
  - Fault tolerant
  - Reliable
- Advantages
  - Fault tolerant
  - Reliable
- Disadvantages
  - Issues regarding Broadcasting
  - Long cable length
  - Expensive



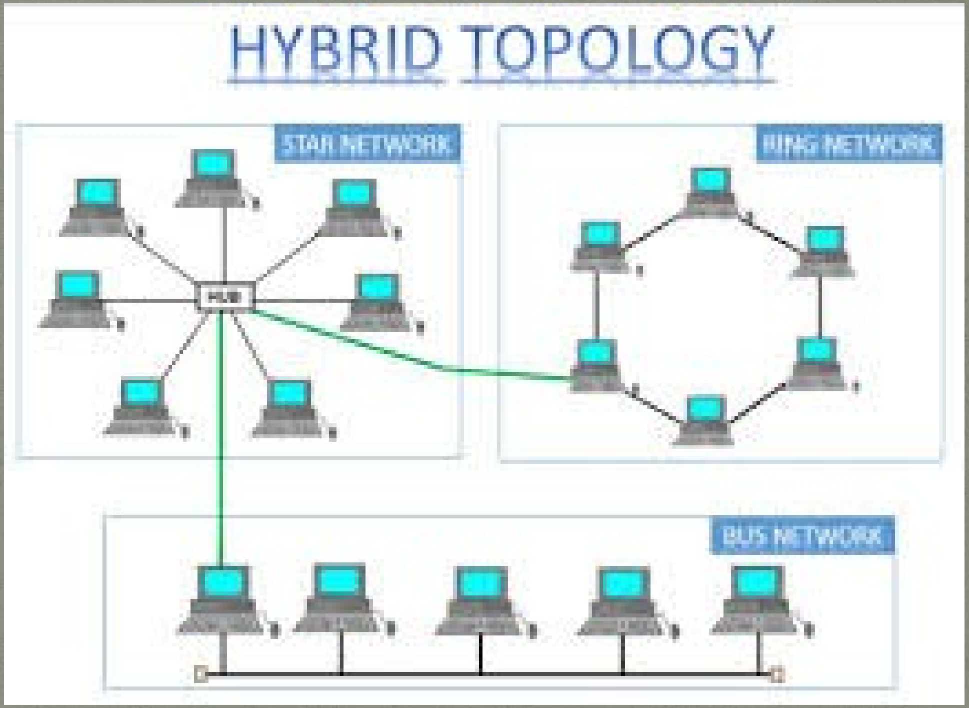
Tree Topology

- Feature
  - Derive From Star
  - Repeaters

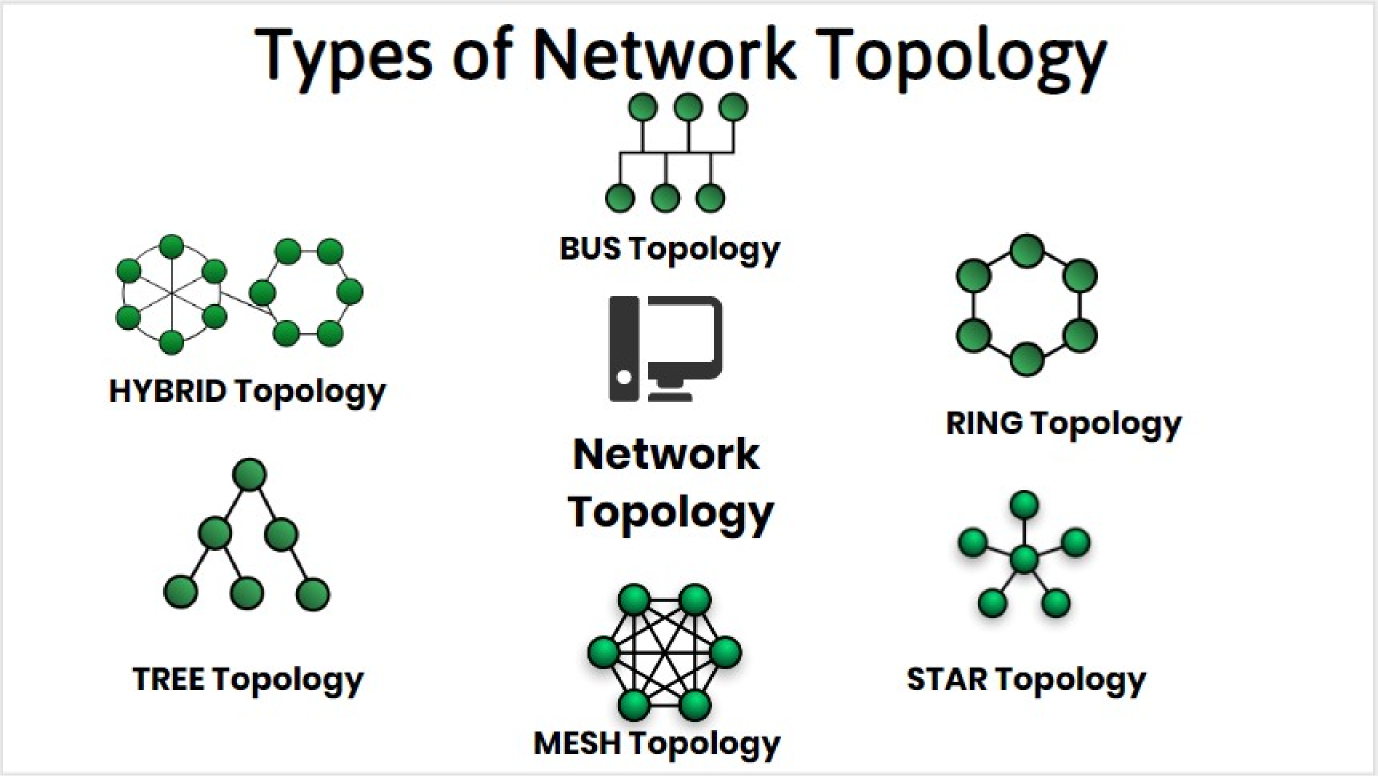


Hybrid Topology

- Combination
  - Star
  - Ring
  - Bus



Network Topologies



Why layering concept is used?

- Layering means to break the problem into more manageable components(layering)
- The design become more simpler and can be easy to troubleshoot

Layered Architecture

- A layer created with different abstraction is needed
- A well defined function
- Internationally standard protocol
- Enough layers to define
- To be test independently

PROTOCOLS

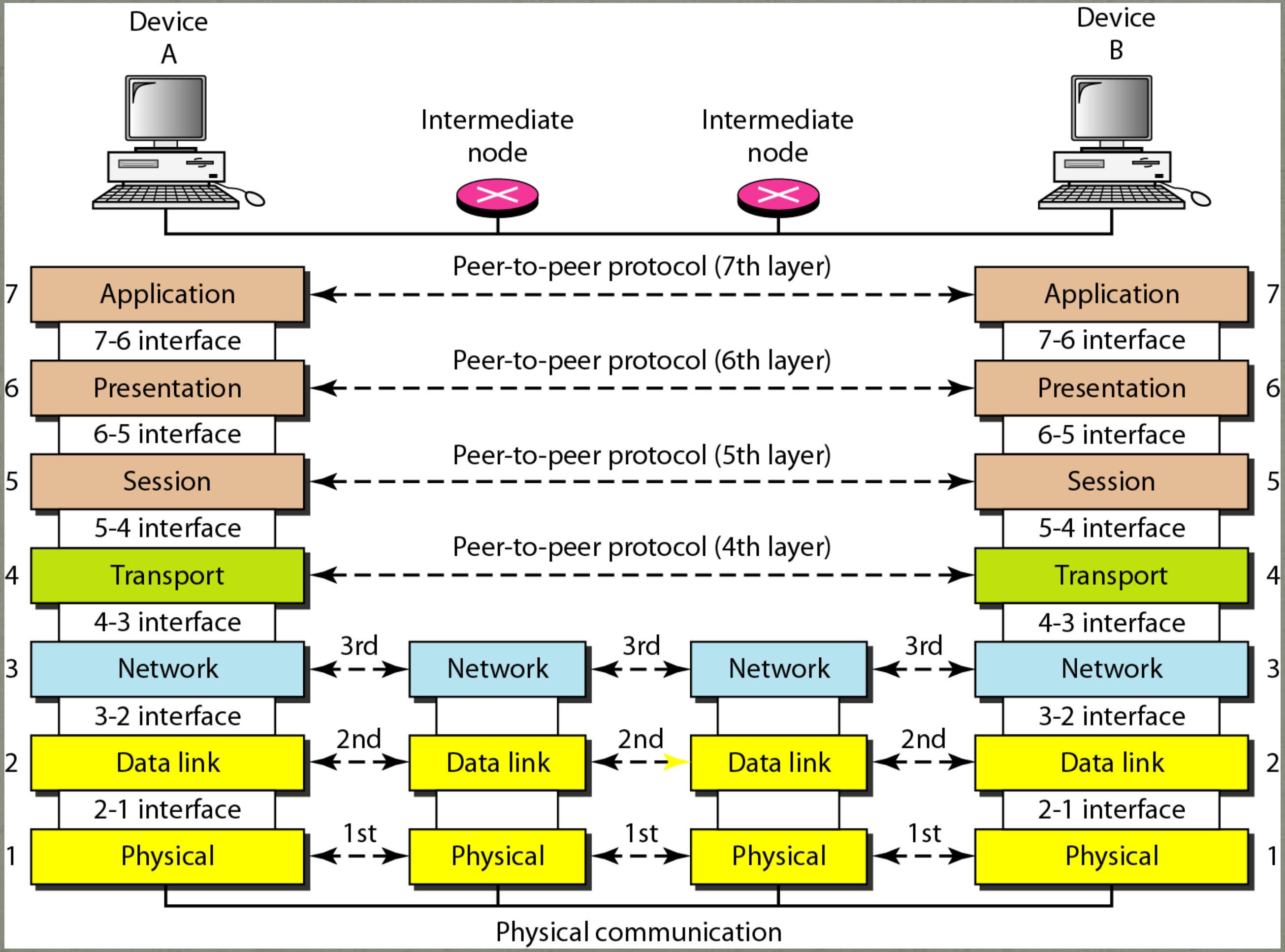
Set of Rules and Regulations

It governs the activities of the data communication

LAYERED ARCHITECTURES

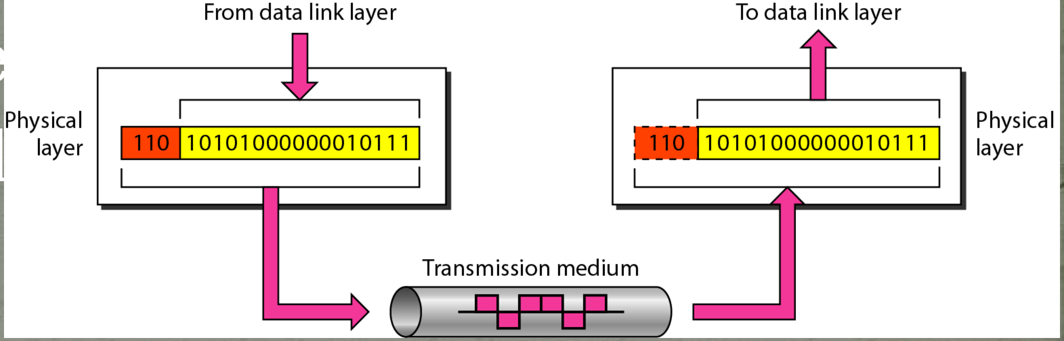
- OSI (Open System Interconnection) reference Model
  - Developed by ISO (International Standards for Organizations)
  - OSI is a model; not a protocol
- TCP/IP (Transmission Control Protocol/ Internet Protocol) Model
  - It is a hierarchical protocol
  - Developed prior to OSI

Open System Interconnection (OSI)



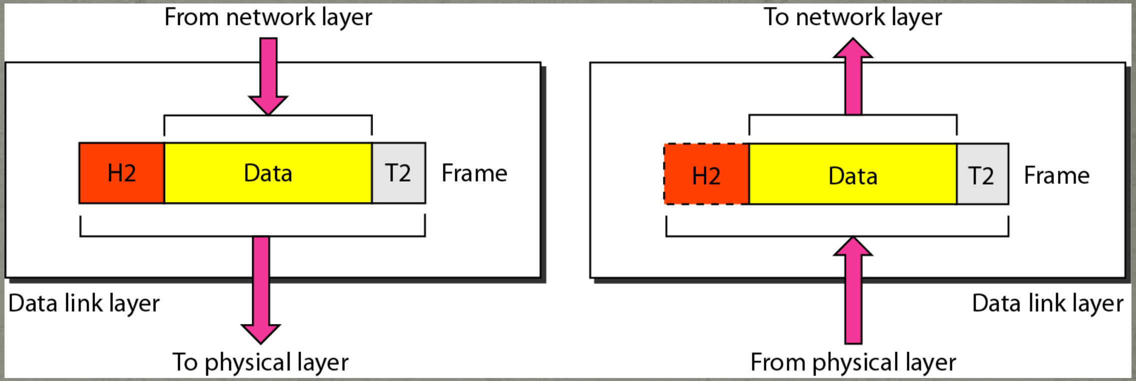
The Physical layer (Bit)

- Signal Encoding
- Medium
- Bit Synchronization
- Transmission type
- Transmission mod
- Topology
- Multiplexing
- Interface
- Bandwidth Signal type



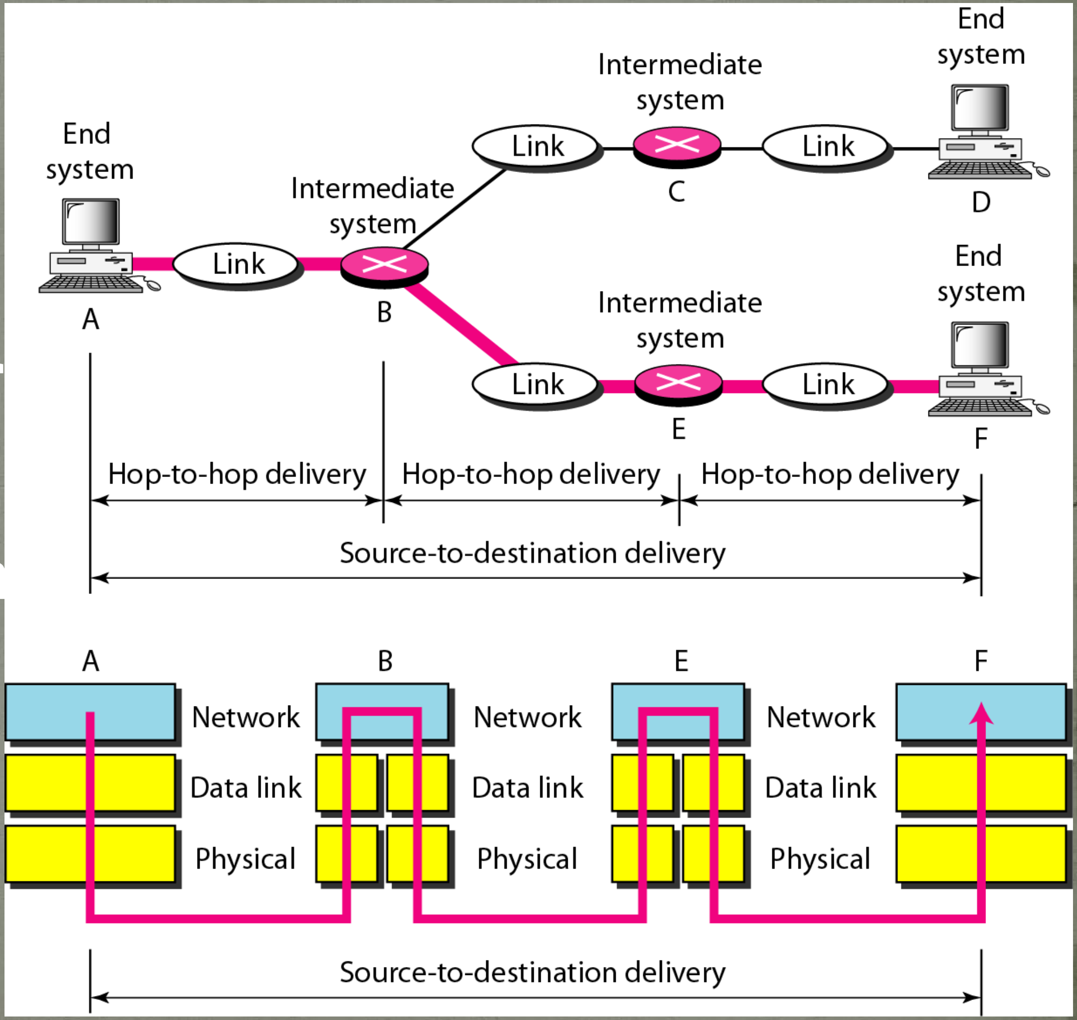
The Data Link Layer (Frame)

- Addressing
- Flow Control
- Media Access Control
- Synchronization
- Error Control
- Node to node delivery



The Network layer (packet)

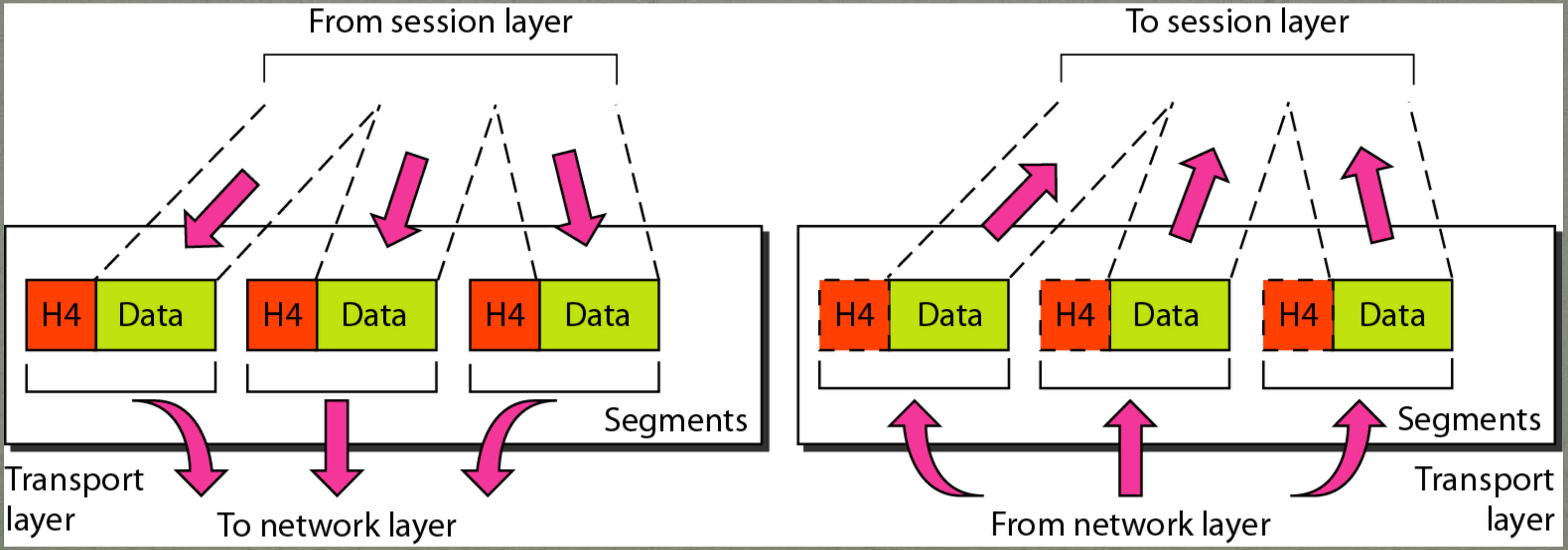
- Routing
- Congestion Contr
- Logical Addressin
- Error Control



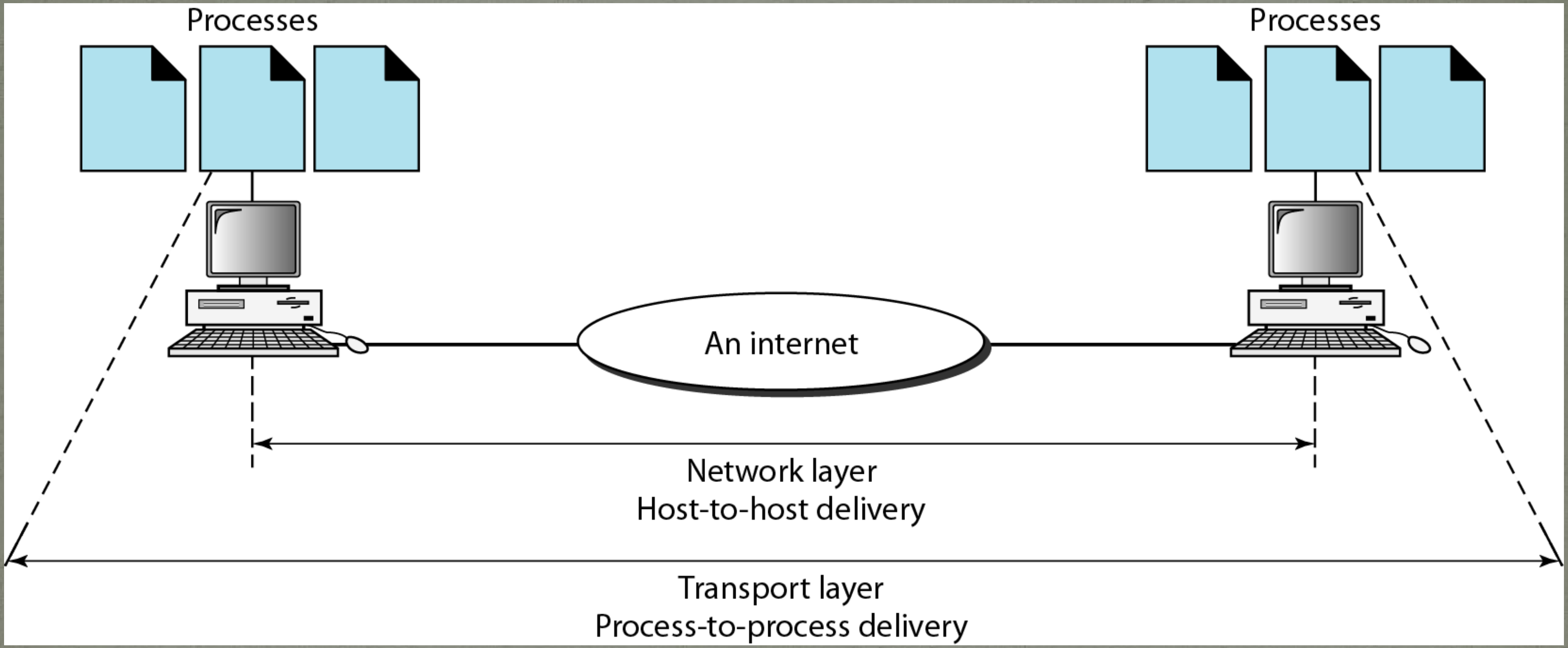
The Transport Layer (Segment)

Host to Host message Delivery

- Application to application communication
- Segmentation reassembly
- Logical connection

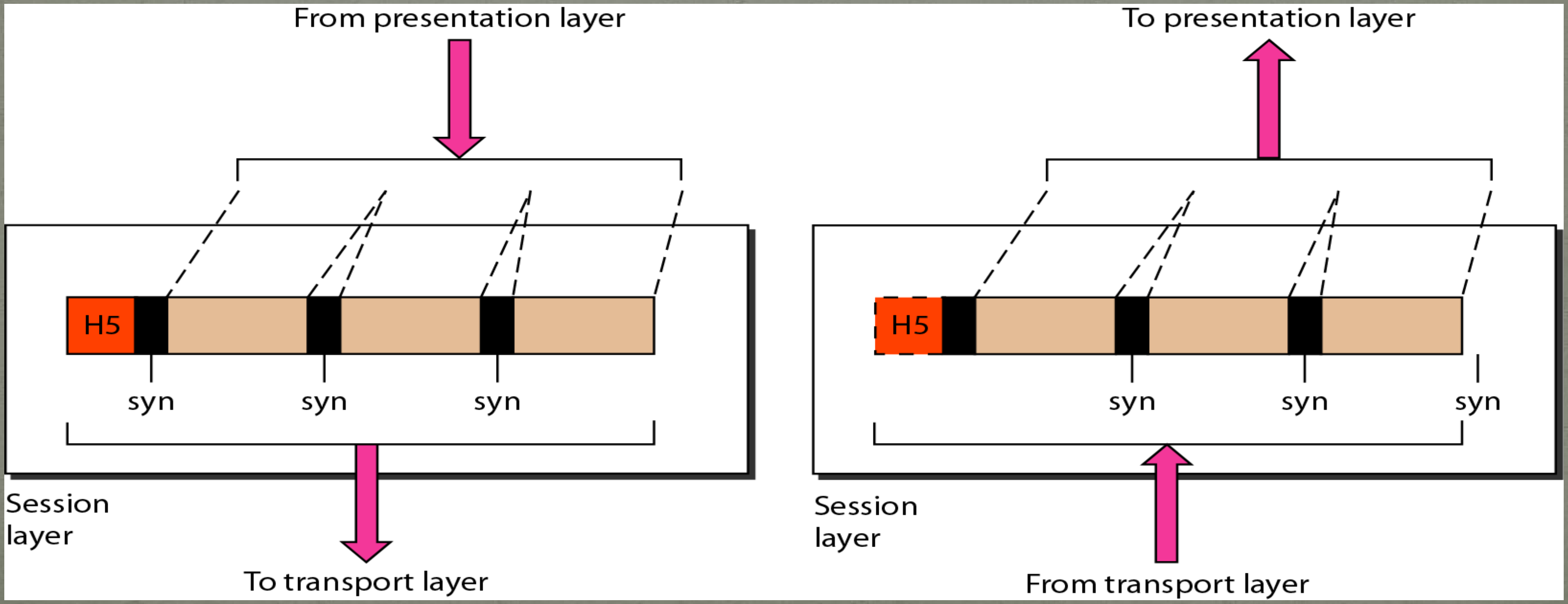


Reliable Process to Process Delivery



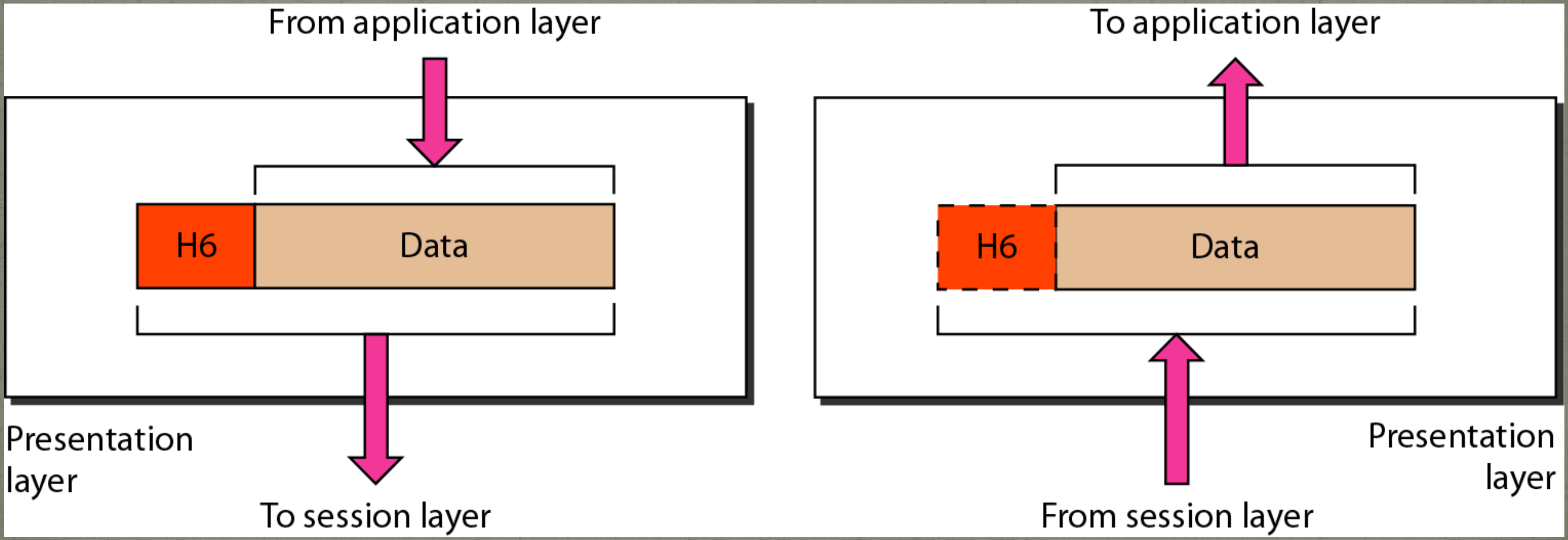
The Session Layer (Data)

- Session and sub session
- Synchronization
- Dialog Control
- Session closure



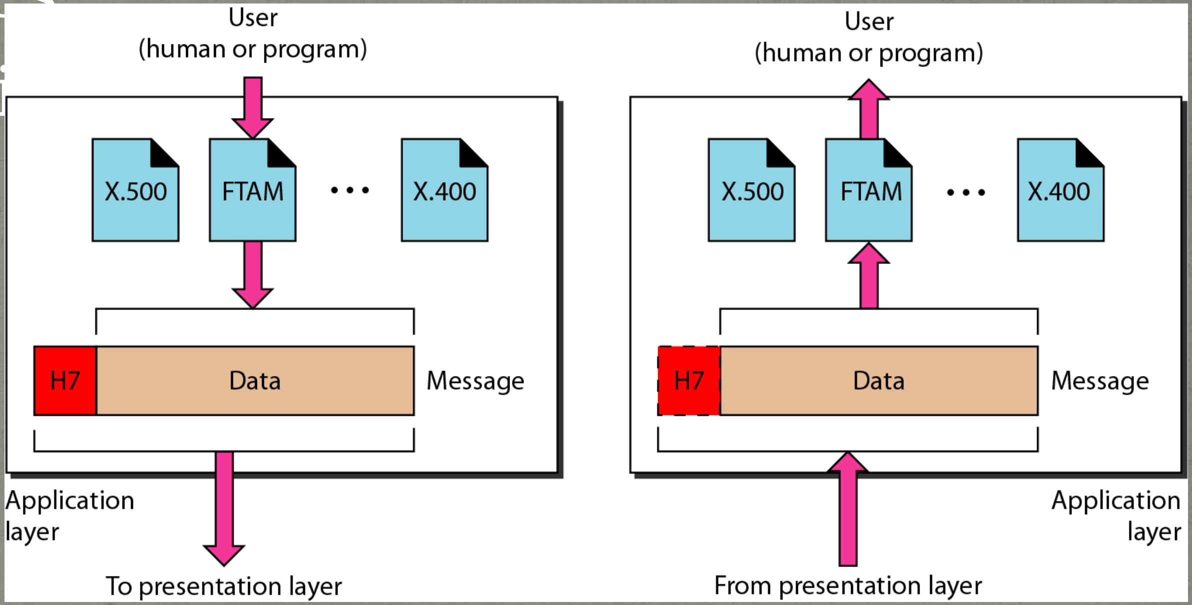
The Presentation Layer (Data)

- Translation
- Encryption
- Compression

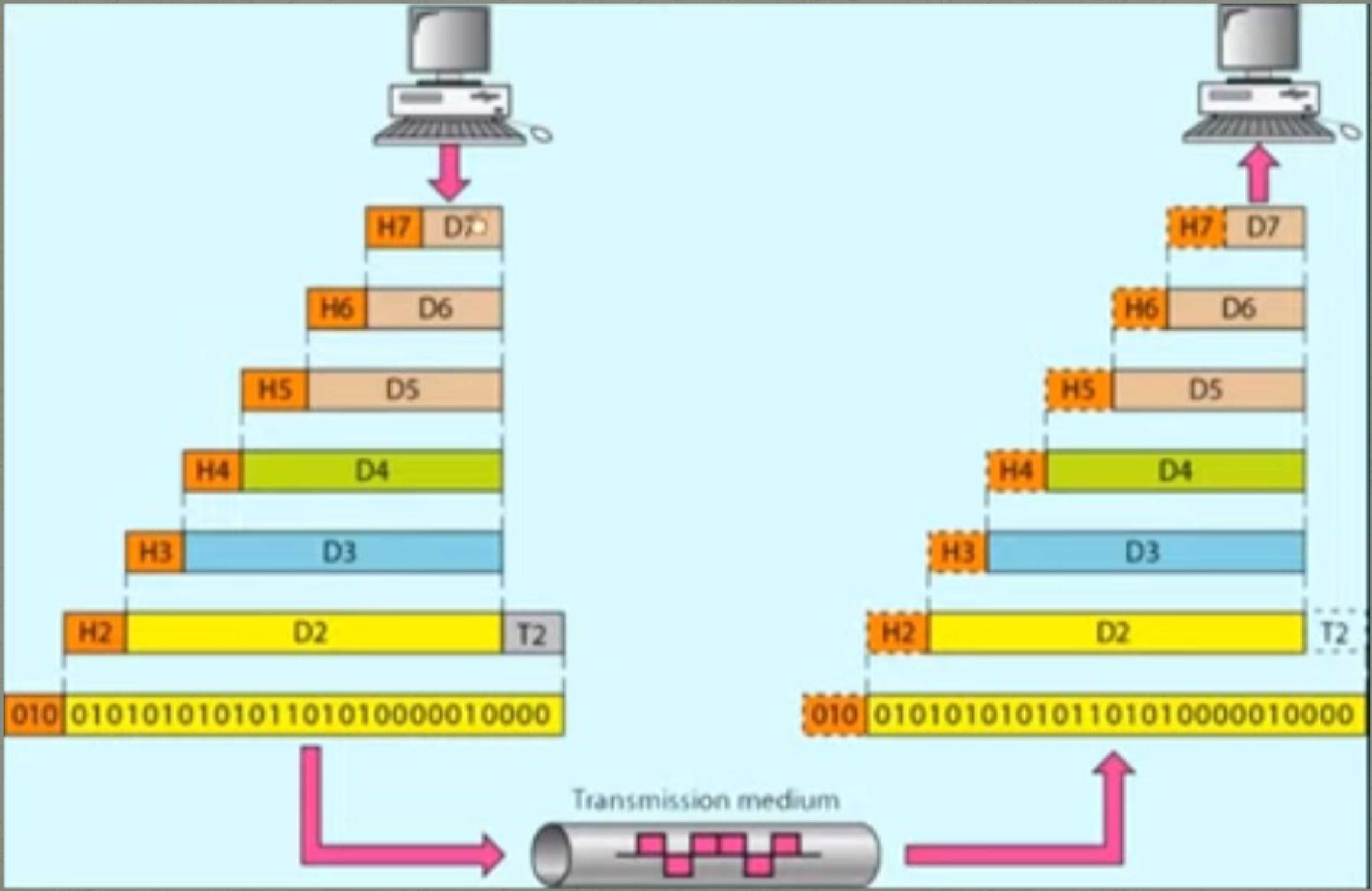


The Application Layer (Data)

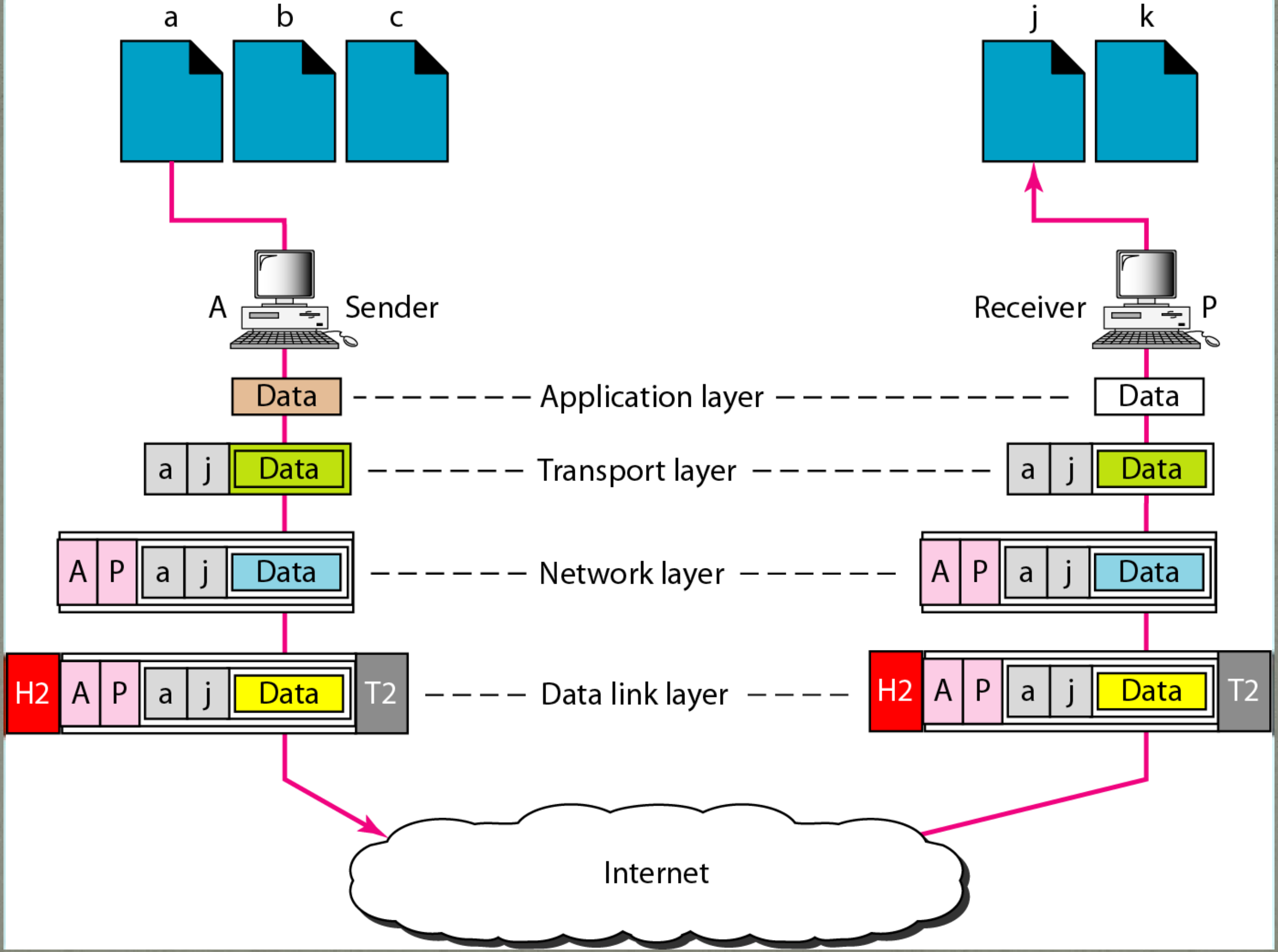
- Network abstraction
- File access and transfer
- Mail services
- Remote logi
- WWW



Working of the OSI reference model



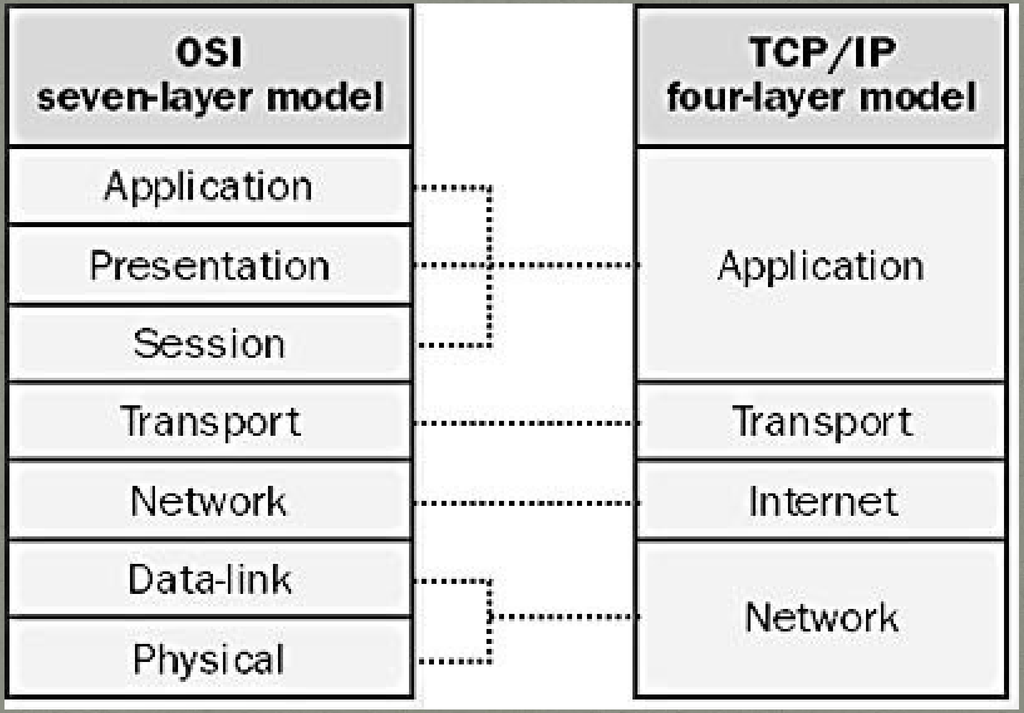
Working of the OSI reference model



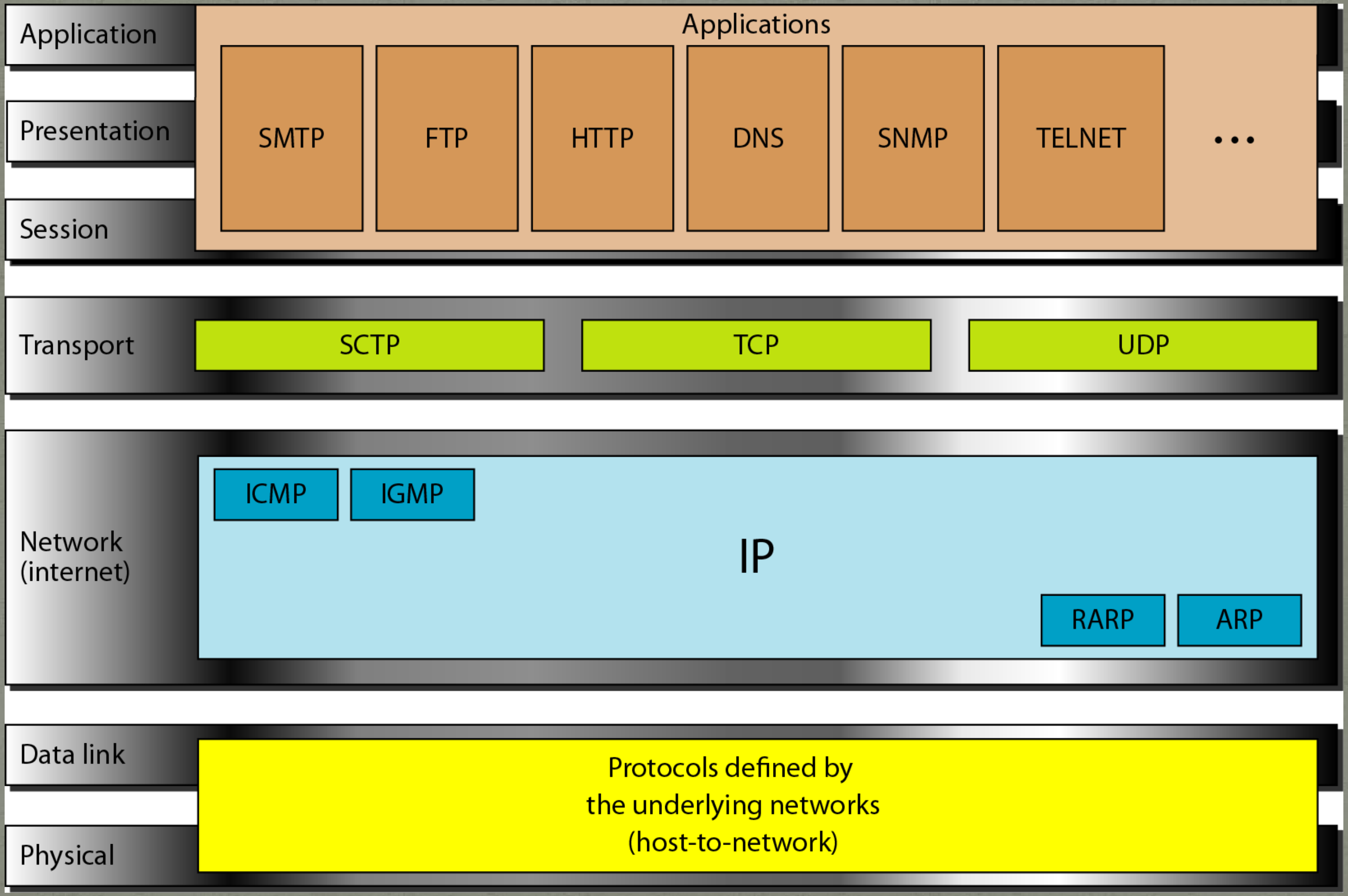
TCP/IP

- *The layers in the TCP/IP protocol suite do not exactly match those in the OSI model.*
- *The original TCP/IP protocol suite was defined as having four layers:*
- *host-to-network, internet, transport, and application.*
- *However, when TCP/IP is compared to OSI, we can say that the TCP/IP protocol suite is made of five layers:*
- *physical, data link, network, transport, and application.*

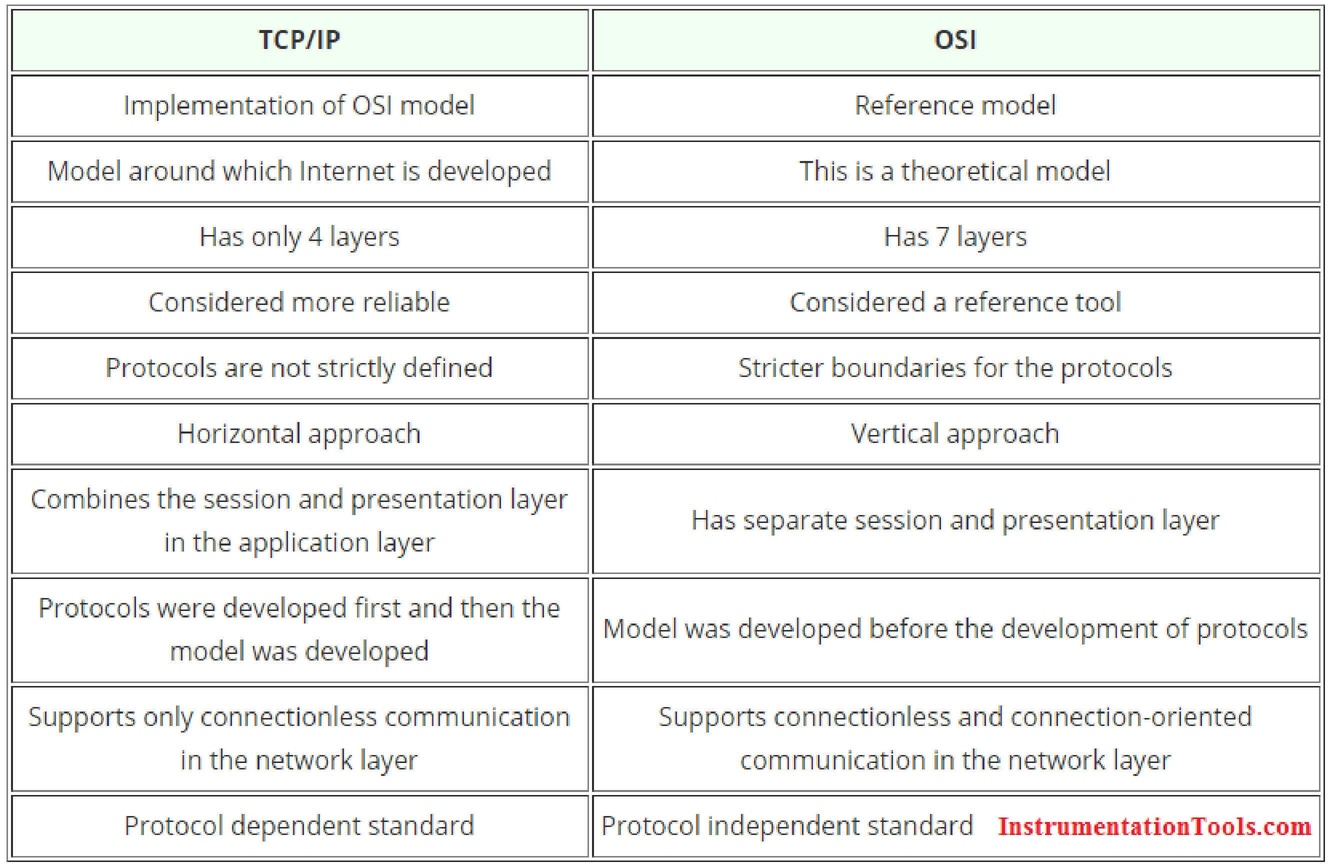
TCP/ IP


OSI
seven-layer model
Application
Presentation
Session
Transport
Network
Data-link
Physical
TCP/IP
four-layer model
Application
Transport
Internet
Network

TCP/IP


Application
Presentation
Session
Applications
SMTP
FTP
HTTP
DNS
SNMP
TELNET
• • •
Transport
SCTP
TCP
UDP
Network
(internet)
ICMP
IGMP
IP
RARP
ARP
Data link
Physical
Protocols defined by
the underlying networks
(host-to-network)

TCP/IP vs OSI



TCP/IP	OSI
Implementation of OSI model	Reference model
Model around which Internet is developed	This is a theoretical model
Has only 4 layers	Has 7 layers
Considered more reliable	Considered a reference tool
Protocols are not strictly defined	Stricter boundaries for the protocols
Horizontal approach	Vertical approach
Combines the session and presentation layer in the application layer	Has separate session and presentation layer
Protocols were developed first and then the model was developed	Model was developed before the development of protocols
Supports only connectionless communication in the network layer	Supports connectionless and connection-oriented communication in the network layer
Protocol dependent standard	Protocol independent standard

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Summary

- By now we know the importance of a Network
- Network Topology plays in Computer Networks
- It’s advantage and disadvantages
- Concept of Layered Architecture
- OSI Reference model
- The internet based on TCP/IP